



Stability and Change in Patterns of Adolescent Antisocial Behavior

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Abstract

Research examining relations between various types of antisocial behavior (ASB) have generally been based on cross-sectional data. Although there is a strong correlation between types of ASB, it has been less common to examine how patterns of adolescents' problems vary over time. This study used a person-oriented approach to examine patterns of ASB in adolescents longitudinally and also investigated how these patterns were associated with three outcomes. The sample consisted of 778 Swedish adolescents in grade 7 (13 years old) followed over time to grade 9. Patterns of ASB were identified based on adolescent-reported tobacco and alcohol use, truancy, bullying in school, and delinquency. The outcomes were drug use, depressive symptoms, and missing grades in grade 9. Results revealed an escalation in the frequency and seriousness of ASB over time, although the largest single cluster over time evidenced no ASB. One cluster in particular increased the risk of drug use, depression, and missing grades at grade 9. Results are discussed in relation to school-based prevention efforts.

Keywords: Antisocial behaviors, Adolescence, Person-oriented analysis, Longitudinal, Cluster analysis

Introduction

Antisocial behavior (ASB) has been referred to as "...criminal and aggressive behaviors, as well as other behaviors that violate the rights of others or major societal norms" (Frick & Viding, 2009, p. 111). ASB involves a consideration of different types of behavior as well as severity level (Cook, Pflieger, Connell & Connell, 2015). ASB can emerge in and change across different developmental periods (Frick & Viding, 2009; Rutter, 2013). When significant, ASB can result in substantial harm and costs to victims and society (Frick & Viding, 2009). It can also result in significant damage to those who engage in ASB, for instance experiencing poor educational attainment and mental illness (e.g., Knapp, McCrone, Fombonne, Beecham & Wostear, 2002; Knapp, McDaid, & Parsonage, 2011). Understanding the development of ASB is vital to the creation of a new generation of effective ASB prevention interventions that

can ameliorate more than one problem (Connell, Cook, Aklin, Vanderploeg, & Brex, 2011). In this study, a person-oriented approach was used to identify patterns of ASB over time in a normative school cohort of Swedish young adolescents and to determine how patterns of ASB relate to selected outcomes at grade 9, such as academic grades, drug use, and depressive symptoms.

Literature Overview

From a lifespan perspective, there is some degree of normality regarding engaging in ASB in earlier developmental periods (Cook et al., 2015). Indeed, a majority of people commit antisocial acts at some time in their lives (Rutter, 2013). Approaches that solely examine the frequency or levels of ASB fail to recognize that there is meaningful heterogeneity in patterns of ASB (Rutter, 2013; von Eye & Bergman, 2003). Several studies have used a pattern-based approach to the study of ASB in children and

adolescents. Some researchers have documented the developmental progression of ASB, while others have focused on a more detailed examination of types and severity of ASB at one point in time (e.g., Connell et al., 2011). While much has been learned from previous research on ASB, future advances in this field will come from using a variety of approaches with diverse samples.

The present study is rooted in the holistic-interactionistic research paradigm (Bergman & Lundh, 2015; Magnusson, 1988) and the conceptual approach of developmental psychopathology (Rutter, 2013). With these wider frameworks as a foundation, this study aims to shed light on typical patterns or configurations as well as continuity and discontinuity in ASB configurations over time. From the holistic-interactionistic research paradigm, of particular importance is the notion that "...the individual is seen as a functioning totality, often best studied by analysing patterns of information, not separate variables, and by searching for typical patterns, each being approximately shared by a subgroup of the total sample" (Bergman & Wångby, 2014, p. 30). This study also concerns the different ways in which youth reach particular outcomes. From the wider vantage point of developmental psychopathology (Rutter, 2013), as well as more ASB-specific theories such as developmental taxonomy approaches (e.g., Moffitt, 2006), it is assumed that youth can reach the same developmental outcome by different routes (i.e., equifinality). For example, adolescents experiencing serious social consequences for criminal behavior (e.g., are incarcerated) may have come to that point through an early starting or adolescent onset ASB path or via other pathways. Which earlier path was taken by the adolescent, in turn has implications for later development and whether offending is likely to continue or stop.

In the ASB field, there are several studies that make use of a pattern approach (e.g., Massoglia, 2006; Nakawaki & Crano, 2015; Sheidow et al., 2008; Sothill, Francis, Ackerley, & Humphrey, 2008). While these studies are not person-oriented or rooted in a holistic-interactionistic framework, such studies can provide some insight into robust ASB patterns that may be expected in adolescent samples. Among studies that have included normative school-based samples, two patterns tend to emerge as typical across studies. The first pattern is that many youth will not engage in ASB or will engage in less serious ASBs. The prevalence varies with age group, methodology, and design of the study, but it can be expected that between 41% to 82% of youth in a normative sample will evidence infrequent patterns of ASB (e.g., Connell et al., 2011; Cook et al., 2015; Dever, Gallagher, Hochbein, Loukas, & Dai, 2017; Sobotkova, Blatný, Jelínek, & Hrdlička, 2012). Another common pattern is that a numerically smaller group of youth will engage in more serious multiple ASBs, consisting of between 2% to 12% of adolescents in a normative school aged sample (e.g., Connell et al., 2011; Cook et al., 2015; Dever et al., 2017; Sobotkova et al., 2012).

Studies by Connell and colleagues (2011) and Cook et al. (2015) provide illustrations of school-based studies within

this research literature that are particularly relevant to the present study. Connell and colleagues (2011) identified four ASB patterns in a normative sample of 1,820 adolescents age 14 at one-time point (54% girls) from 21 towns and municipalities in the United States (U.S.). Latent class analysis indicated that four classes adequately described the patterns of behaviors (Connell et al., 2011). Two classes made up 82% of the sample and reported no ASB or had a low probability of ASB. The other more problem-oriented classes were either characterized by moderate ASB, but with a low probability of reporting drug use or experiencing social or legal consequences from their ASB (12%) or with multiple problems with greater severity (e.g., drug use, aggressive behavior, property offenses) and substantial consequences arising from their ASBs (6%).

Also, using latent class analysis, Cook et al. (2015) identified four ASB classes based on a longitudinal sample of 5,422 adolescents living in the U.S. (54% girls). The adolescents were approximately 14 years old at the time and the largest class, defined by no ASB, comprised of 70% of the girls and 59% of the boys. Two classes consisted of aggressive and petty theft, and a fourth more serious multi-problem class included 4% of the girls and 7% of the boys. Then, using latent transition analysis, results showed that adolescents consistently involved in serious ASB were likely to have the poorest young adult adjustment as indexed by criminal justice involvement, poor educational attainment, depression, and drug use problems. Those consistently not involved in ASB were likely to have the best later adjustment. Those with time-limited ASB involvement (either escalating or de-escalating during adolescence) were more likely to fare worse than those that were consistently not involved in ASB but fared better than those consistently involved in serious ASB over time (Cook et al., 2015).

ASB in adolescence has been associated with various adverse outcomes in late adolescence and adulthood (Bongers, Koot, Van der Ende, & Verhulst, 2008; Miller, Malone, & Dodge, 2010; Sheidow et al., 2008). However, few have examined how different patterns of ASB predict adverse outcomes later in life. The holistic-interactionistic research paradigm (Bergman & Lundh, 2015; Magnusson, 1988) highlights the importance of conducting research studies aimed at better understanding intersections across different domains of functioning (e.g., behavioral, psychological, social). From this perspective, it makes sense to posit that certain typically occurring patterns of ASB could be differentially related to the functioning of young people in terms of mental health and academic achievement (Tetzner, Kliegl, Krahé, Busching, & Esser, 2017). A Swedish study by Wångby, Bergman, and Magnusson (1999) showed that one expected configuration of problems in normative adolescent samples is likely to include a multiple problem group in which there are substantial elevated problems that include externalizing and internalizing problems such as depression.

Pattern-oriented studies that link ASB related problem configurations to academic achievement are not plentiful,

but available evidence indicates that youth with certain configurations of problems (e.g., those with elevated multiple problems) are often likely to have academic difficulties. An illustrative empirical example is a U.S. based study with 675, 6th graders (Orpinas, Raczynski, Peters, Colman, & Bandalos, 2015). Using latent profile analysis, seven ASB configurations were identified. A relatively low percentage of students in the well adapted (4%) and average configurations (9%) at grade 6 later dropped out from school. The rate of school drop-out was comparably higher in the five problem-related configurations, with the highest for the configuration with elevated problems across all domains (58%).

Another example is a German study of a normative school sample of 1,665 adolescents (50% girls) with a mean age of 13 years old (Tetzner et al., 2017). The study examined configurations of depression, aggression, and academic performance over a two-year period. Latent profile analyses indicated three configurations, with most of the youth (80%) evidencing no significant problems in depression or aggression and were doing average or better in school. The two remaining configurations were characterized by multiple problems, one group reporting elevated problems, particularly depression combined with significant problems with aggression and school, and the other configuration reporting elevated problems particularly with aggression and some significant problems with depression but doing average in school. Tetzner et al. (2017) concluded that transitions between symptomatic groups were rare, and that transitions were most likely to occur from the symptomatic types toward the asymptomatic group.

Study Aims

In this study, we use a person-oriented approach to examine patterns of ASB over time, as well as investigate whether the resulting configurations predict later illicit drug use, academic achievement, and depressive symptoms in a Swedish normative sample of early adolescents. Illicit drug use was modeled as an outcome rather than an indicator of ASB for methodological reasons; at grade 7 only 1.5% students reported illicit drug use, and at grade 8 2.3% (more details are provided in the Method section). The comparably low Swedish prevalence in illicit drug use during adolescence in this sample is consistent with international comparative research (ESPAD group, 2016). The focus on early adolescents is considered advantageous as it precedes an important social and cultural transition for Swedish adolescents as grade 9 represents the last year before young people go to high school (called gymnasium in Sweden). Grades earned by students in grade 9 are especially influential in determining the range of choices that youth have in terms of educational tracks.

Based on the two frameworks important to this study (i.e., the holistic-interactionistic research paradigm – Bergman & Lundh, 2015; Magnusson, 1988 and developmental psychopathology – Rutter, 2013), it was expected that typical patterns or configurations of ASBs would be identified in the present study sample, such as a configuration that was

relatively ASB free or low over time as well as, at least by the 9th grade there would be a configuration characterized by serious multiple ASBs. Other configurations at the beginning of the study (at Time 1) and across time were viewed as possible, but these two patterns were expected given prior studies (e.g., Connell et al., 2011; Cook et al., 2015).

The research aims connected with these expectations were as follows: (1) Identify behavior patterns (clusters) of tobacco use, alcohol use, delinquency, truancy and bullying for adolescents in grade 7, 8 and 9; (2) investigate whether the same behavior patterns can be identified in grade 7, 8 and 9 (structural stability); and (3) investigate to what extent adolescents displayed similar patterns of ASB over time (individual stability). Finally, (4) consistent with the concept of equifinality, it was expected that the outcome of focus in this study, namely illicit drug use, academic achievement, and depressive symptoms towards the end of early adolescence would be differentially associated with particular prior ASB patterns in this sample (i.e., youth reaching a given outcome such as adequate to good academic achievement) but with a limited number of earlier ASB patterns associated with that outcome. Due to the few relevant prior empirical studies on this topic that have used a pattern-oriented approach, with other relatively contemporary normative Swedish adolescent samples, except for the expectations noted, the research aims were largely exploratory rather than predictive.

Method

Participants and Procedure

Participants took part in the 21 Swedish Junior High Schools Study, a study designed to examine the effects of various school-based preventive interventions (Ferrer-Wreder, Sundell, Eichas, & Habbi, 2015). The study involved 21 junior high schools, of which 11 were intervention schools, and 10 were control schools. Of the schools, 14 were in the main Swedish metropolitan areas and seven were in rural areas. At baseline, participants were in Grade 7 (approximately 13 years of age) in the autumn of 2004 and were followed to Grade 9. The study spanned a three-year period (with youth assessments in Fall 2004, Spring 2005, Spring 2006, and Spring 2007). The interventions began in Fall 2005.

Active consent from at least one caregiver was required for study participation. Consent was given for 1,436 adolescents (68%) and was denied in 114 cases (5%), and no response was received from 576 parents or caregivers (27%). Thirteen adolescents requiring special education were excluded from the study. Adolescents answered the questionnaires while in school, during one dedicated session of 40 minutes for each wave, supervised by a teacher. The questionnaires were confidential, and adolescents were informed that neither the teacher nor their parents would be able to access their questionnaire. The sample was limited to adolescents in the 7th to 9th grade cohorts who completed all three waves (spring 2005-spring 2007) and had

complete data on the clustering variables ($N=778$; 374 girls and 404 boys). The two main reasons for the large drop-out are students temporary absence at the data collection (e.g., illness), and a permanent transfer to another school due to the Swedish school voucher system.

The project received ethics approval by the National Board of Health and Welfare 2003-12-08 (File Number: 68-392/2000).

Measures

Adolescent questionnaires were identical for Grades 7 to 9 and contained a wide range of items on behavior and attitudes.

Tobacco use. Adolescents answered two questions about how often they smoked cigarettes and used smokeless tobacco, and they rated these items on a 5-point scale with the following response options: 1 (never tried), 2 (tried), 3 (former use), 4 (sometimes but not daily), and 5 (daily). Tobacco use was recoded into 1 = No tobacco use; 2 = Tried cigarettes and/or smokeless tobacco; 3 = Smokes cigarettes and/or uses smokeless tobacco occasionally; 4 = Smokes cigarettes and/or use smokeless tobacco daily.

Alcohol use. Adolescents answered one question about how many times in their life-time they had been drunk, which was rated on a 5-point scale ranging from 1 (never) to 5 (more than 10 times).

Delinquency. Delinquency was measured with a scale based on Ring's (1999) research on crime committed by primary school students. The scale comprises items about whether students committed 19 types of crime over the past 12 months. Adolescents rated the items on a 5-point Likert scale ranging from 1 (never) to 5 (more than 10 times). In the present study, delinquency was coded according to: 1 = no crimes; 2 = one less serious crime; 3 = several less serious crimes; 4 = one or more serious crimes. 'Less serious crimes' consisted of seven items descriptive of crimes with a low penalty value (e.g., shoplifted, painted graffiti), whereas 'serious crimes' consisted of five items descriptive of crimes with high penalty value or crimes characterized by violence (e.g. stealing a car, burglary, beating someone).

Truancy. Students answered one question about skipping school a whole day during the school year on a 5-point scale ranging from 1 (no) to 5 (more than ten times). Due to low frequencies in the higher response alternatives, truancy was recoded into 1 = No; 2 = Yes, once; 3 = Yes, 2-3 times; 4 = Yes, more than 3 times.

Bullying. Bullying at school was measured with one question about whether students had bullied other students during the school year. Students rated the bullying item on a 5-point scale ranging from 1 (never) to 5 (several times a week). Due to low frequencies in the higher response alternatives, bullying was recoded into 1 = I have not bullied / harassed anyone; 2 = It has happened very occasionally; 3 = 2-3 times a month to several times a week.

Illicit drug use. Students reported how often they had ever used inhalants, cannabis and other illicit drugs (three items). Each substance was rated on a 5-point scale ranging

from 1 (never) to 5 (more than 10 times). Due to low frequencies of reported illicit drug use, the variable was coded as 1 = Never drug use; 2 = At least once drug use.

School grades. Data on adolescents' school performance for the autumn semester of Grades 8 and 9 were obtained from school registry information on academic grades. In the Swedish school system, students were at the time given grades from the 8th grade and forward. In this study, only Grade 9 grades are used. The subjects Swedish, English and Mathematics are compulsory for all students. School grades were coded into 1 = Pass grades in all three subjects, 0 = No grade in one or more subjects. This categorization was used to indicate if students were eligible to apply to high school or not.

Depressive symptoms. Depressive symptoms were measured with a widely used Swedish translation of the Center for Epidemiological Studies-Depression Children (CES-DC; Olsson & von Knorring, 1997). This scale consists of 20 items on how adolescents felt during the past week. Sample items include questions about whether they felt "down" and unhappy, worried about things they do not usually worry about, and had difficulty getting started with what they should do. Students rated these items on a 4-point scale ranging from 1 (not at all) to 4 (often). Ratings were summed up to generate a total depressive symptoms score. The reliability (Cronbach's alpha) was .91. The CES-DC also provides cutoff scores (i.e., 16 or greater) that aid in identifying individuals at risk for clinical depression, with good sensitivity and specificity and high internal consistency (Rutman, Shenassa, & Becker, 2008; Weissman, Orvaschel, & Padian, 1980). Scores above 15 were coded as depressive symptoms.

Plan of Analyses

Because variable-oriented outcome evaluation analyses for the intervention trial did not indicate any significant intervention-related main effects, and intervention effects were only found for subgroups of study participants (Ferrer-Wreder et al., 2015), it was decided to merge all participants regardless of their study condition. This approach has been used previously when differences are small between study conditions in other intervention trials (e.g., Schwartz, Mason, Pantin, & Szapocznik, 2008). The combined data set increased statistical power considerably, and thereby improved the chances of identifying stable clusters in the person-oriented analysis. The adequacy of this strategy was tested and is addressed further at the beginning of the results section.

A cluster analytic method was used to identify subgroups of individuals with similar behavior patterns of tobacco use, alcohol use, delinquency, truancy, and bullying. We initially included drug use in the cluster analysis of ASB. However, because the frequencies of illicit drug use were low and the majority of adolescents with reported illicit drug use ended up in the residue groups, we decided to exclude it and instead include this variable as an outcome in the analyses. Cluster analysis was performed in SLEIPNER (Bergman &

El-Khoury, 1998). The cluster analysis and the linkage of clusters between different grades followed the LICUR procedure (Bergman, Magnusson & El-Khoury, 2003). As recommended by Bergman (1988), multivariate outliers were first identified and excluded from the cluster analysis with the RESIDUE module. In total, 38, 16, and 7 individuals were excluded in grade 7, 8 and 9 respectively. Ward's method of hierarchical cluster analysis with standardized values was then used on the data from the remaining individuals for each grade separately. The choice of cluster solution was guided by the LICUR criteria (Bergman, Magnusson & El-Khoury, 2003), which means it was based on identifying theoretically meaningful clusters, finding a cluster solution with explained error sum of squares (EESS) above 67%, and choosing a cluster solution with one more cluster in case there was a rapid decrease in the explained error sum of squares (EESS) by decreasing the number of clusters. In addition, we chose cluster solutions that did not include clusters with few individuals. After deciding on the number of clusters, the RELOCATE module was used to relocate individuals between clusters to maximize the cluster homogeneity.

The centroid method was used to examine structural stability between clusters at different grades (Bergman et al., 2003), that is, the extent to which two clusters has similar shapes. This method calculates the Average Squared Euclidian Distance (ASED) between the centroids of two clusters. Lower ASED indicates structural stability. EXACON was used to examine individual stability in cluster membership over time (Bergman & El-Khoury, 1998). EXACON is a cell-wise test, which examines whether the obtained frequency in a cell in a contingency table differs significantly from the expected frequency. An obtained frequency significantly higher than the expected frequency is called a "type". Similarly, an obtained frequency significantly lower than expected is called an "antitype". Thus, this method examined typical and atypical development over time.

The χ^2 test was used to test cluster differences in illicit drug use, school grades, and depressive symptoms. The contingency tables were also analyzed cell-wise with EXACON. Multiple comparisons (post hoc tests) were examined with Tukey's honestly significant difference test. Holm's method of adjustment for multiple testing (Aickin & Gensler, 1996) was used in the EXACON analyses regarding individual stability and in the analyses of cluster differences in illicit drug use, school grades, and depressive symptoms.

Results

Preliminary Analyses

Comparison of students included and not included in the study. A comparison of students included and those not included (i.e., those without complete data on the clustering variables) in this study showed that significantly fewer

adolescents in the current sample reported nicotine use, alcohol use, delinquency, truancy and bullying in all three grades. Furthermore, significantly fewer students included in this study reported illicit drug use, depressive symptoms, and having no grade in at least one of the subjects Swedish, English, and Mathematics in grade 9. This indicates that students that remained in the study were better adjusted compared with the total group of students. For more information on differences between those included and those not included in the study, see supplementary Table 1 in Appendix.

Comparison of students in intervention and control schools. A comparison of students in intervention and control schools showed no differences in the clustering variables with the exception of a significantly higher proportion of students in control schools reporting bullying in grade 9, and significantly more students in control schools reported illicit drug use in grade 9, relative to the students in the intervention schools. Similar clusters were identified in intervention and control schools in grade 9 (i.e., after the interventions took place). However, one difference was that the cluster including bullying also comprised tobacco and alcohol use in the intervention schools, but not in the control schools. In addition, the multi-problem cluster did not include bullying in intervention schools. Despite these differences, the results for the intervention and control schools were considered similar enough to analyze them together. For more information on differences between intervention and control schools, see supplementary Table 2 in the Appendix.

Comparison of girls and boys. Boys and girls were analyzed together in this study. Despite gender differences in all clustering variables (in some grades), separate cluster analyses revealed similar clusters for boys and girls in grades 7, 8, and 9, and the identified clusters were similar with respect to both shape and level. However, some minor differences in the cluster solutions were identified. In grade 7, girls in the cluster including truancy reported more tobacco and alcohol use, than did boys in the corresponding cluster. In grade 8, two clusters included truancy for girls, whereas two clusters included bullying for boys. In grade 9, the multiple-problem cluster among girls included higher levels of truancy than the corresponding cluster among boys. In addition, the cluster with truancy included more tobacco use and alcohol use among girls than the corresponding cluster among boys. Despite these differences, the results for boys and girls were considered similar enough to analyze them together. For more information on differences between girls and boys, see supplementary Table 3 in Appendix.

Main Analyses

Descriptive information about the variables included in this study is presented in Table 1. Of interest is that all ASB, except bullying, increased in frequency from grade 7 to grade 9.

Table 1. *Descriptive information for the included variables.*

	Grade 7 <i>n</i> (%)	Grade 8 <i>n</i> (%)	Grade 9 <i>n</i> (%)
Tobacco use (any)	185 (23.8)	251 (32.3)	367 (47.2)
Alcohol use (any)	91 (11.7)	182 (23.4)	361 (46.4)
Delinquency (any)	360 (46.3)	392 (50.4)	454 (58.4)
Truancy (any)	64 (8.2)	75 (9.6)	144 (18.5)
Bullying (any)	100 (12.9)	89 (11.4)	82 (10.5)
No school grade (≥ 1 subjects) ^a			35 (4.6)
Illicit drug use			38 (4.9)
Depressive symptoms ^b			282 (36.8)

^a Information available for 764 students^b Information available for 767 studentsTable 2. *Cluster solution in grade 7 describing centroids, number of individuals (n) and homogeneity coefficients (h.c.).*

Cluster	Tobacco use	Alco- hol use	Delin- quency	Truan- cy	Bully- ing	<i>n</i>	<i>h.c.</i>
Well-adjusted	1.00	1.02	1.00	1.02	1.00	331	0.06
Delinquency	1.00	1.06	2.56	1.04	1.00	187	0.34
Tobacco use & Delinquency	2.03	1.06	1.82	1.03	1.00	98	0.58
Tobacco use, Alcohol use & Delinquency	1.94	3.00	2.42	1.06	1.15	33	2.36
Delinquency & Truancy	1.67	1.67	2.71	3.38	1.10	21	4.94
Delinquency & Bullying	1.30	1.07	2.31	1.03	2.23	70	1.43

Table 3. *Cluster solution in grade 8 describing centroids, number of individuals (n) and homogeneity coefficients (h.c.).*

Cluster	Tobacco use	Alco- hol use	Delin- quency	Truan- cy	Bully- ing	<i>n</i>	<i>h.c.</i>
Well-adjusted	1.14	1.08	1.00	1.01	1.00	339	0.17
Delinquency	1.30	1.12	2.59	1.00	1.00	237	0.41
Tobacco use, Alcohol use & Delinquency	2.43	3.51	2.49	1.11	1.11	65	1.75
Delinquency & Truancy	1.53	1.39	2.39	2.72	1.00	36	1.63
Delinquency & Bullying	1.61	1.60	2.20	1.00	2.17	70	1.52
Multi-problems	3.47	4.73	3.00	3.13	1.00	15	1.67

Table 4. *Cluster solution in grade 9 describing centroids, number of individuals (n) and homogeneity coefficients (h.c.).*

Cluster	Tobac- co use	Alco- hol use	Delin- quency	Truan- cy	Bully- ing	<i>n</i>	<i>h.c.</i>
Well-adjusted	1.25	1.39	1.00	1.07	1.00	273	0.28
Delinquency	1.27	1.31	2.53	1.05	1.00	206	0.32
Tobacco use, Alcohol use & Delinquency	2.61	4.01	2.49	1.12	1.00	147	0.89
Tobacco use, Alcohol use, Delinquency & Truancy	2.36	3.23	2.6	3.41	1.00	70	1.45
Delinquency & Bullying	1.33	1.75	2.28	1.23	2.00	40	0.89
Multi-problems	3.26	4.43	3.17	2.20	2.29	35	2.11

Table 5. Typical (type) and atypical (antitype) movements between clusters in grade 7 and grade 8.

Clusters grade 7	Clusters grade 8					
	Well-adjusted	Delinquency	Tobacco, Alcohol & Delinquency	Delinquency & Truancy	Delinquency & Bullying	Multi-problems
Well-adjusted	215 ^T	77 ^{AT}	9 ^{AT}	10	14 ^{AT}	1
Delinquency	63 ^{AT}	99 ^T	7	8	9	1
Tobacco & Delinquency	33	28	20 ^T	4	10	1
Tobacco, Alcohol & Delinquency	5 ^{AT}	6	14 ^T	0	5	1
Delinquency & Truancy	2 ^{AT}	3	1	9 ^T	0	3 ^T
Delinquency & Bullying	15 ^{AT}	22	3	2	26 ^T	0

T=Type; AT=Antitype

Results are adjusted for multiple testing.

Note that the residue groups have been excluded from this analysis (grade 7: n=38, grade 8: n=16).

Table 6. Typical (type) and atypical (antitype) movements between clusters in grade 8 and grade 9.

Clusters grade 8	Clusters grade 9					
	Well-adjusted	Delinquency	Tobacco, Alcohol & Delinquency	Tobacco, Alcohol, Delinquency & Truancy	Delinquency & Bullying	Multi-problems
Well-adjusted	208 ^T	80	28 ^{AT}	15 ^{AT}	6 ^{AT}	1 ^{AT}
Delinquency	47 ^{AT}	106 ^T	48	13	13	8
Tobacco, Alcohol & Delinquency	3 ^{AT}	1 ^{AT}	47 ^T	6	0	7
Delinquency & Truancy	3 ^{AT}	8	3	18 ^T	1	3
Delinquency & Bullying	10 ^{AT}	11	14	4	20 ^T	9 ^T
Multi-problems	0 ^{AT}	0	3	10 ^T	0	2

T=Type; AT=Antitype

Results are adjusted for multiple testing.

Note that the residue groups have been excluded from this analysis (grade 8: n=16, grade 9: n=7).

Table 7. Frequencies (and percentages) of adolescents in different clusters in grade 9 with illicit drug use, no grade in at least one subject (English, Mathematics and/or Swedish) and depressive symptoms.

Cluster	Drug use	No school grade (≥ 1 subjects)	Depressive symptoms
Well-adjusted	3 (1.1) ^{AT}	14 (5.3)	60 (22.3) ^{AT}
Delinquency	0 (0.0) ^{AT}	5 (2.4)	84 (41.4)
Tobacco use, Alcohol use & Delinquency	15 (10.2) ^T	2 (1.4)	62 (42.8)
Tobacco use, Alcohol use, Delinquency & Truancy	8 (11.4) ^T	10 (14.9) ^T	38 (55.1) ^T
Delinquency & Bullying	1 (2.5)	0 (0.0)	17 (43.6)
Multi-problems	10 (28.6) ^T	2 (5.9)	18 (51.4)

Results are adjusted for multiple testing.

Note that the residue groups have been excluded from this analysis (grade 9: n=7).

Cluster solutions. Cluster solutions with six clusters were chosen for grades 7, 8, and 9 (Tables 2-4). The explained Error Sum of Squares (ESS) were 72.1, 70.5, and 69.0 respectively. Four clusters were identified in all three grades; a cluster with “well-adjusted” individuals and three clusters characterized by “delinquency”, “tobacco use, alcohol use, and delinquency”, and “delinquency and bullying”. In grade 7, there was also a cluster with “tobacco and

delinquency”, which was not found in grades 8 and 9. In both grades 7 and 8, a cluster characterized by “delinquency and truancy” was found, which in grade 9 also included tobacco use and alcohol use (“tobacco use, alcohol use, delinquency and truancy”). In grades 8 and 9, a “multi-problem” cluster was identified.

There was no cluster that only involved alcohol use, tobacco use, truancy or bullying, thus indicating that ASBs

normally co-occur. Truancy occurred in one (grade 7) or two clusters (grade 8 or 9), and bullying in one (grade 7 and 8) or two cluster (grade 9). Alcohol use mainly occurred in one cluster at grade 7, in two clusters at grade 8 and three clusters at grade 9. Except the well-adjusted cluster, all other clusters at all grades involved some extent of delinquency. Present tobacco use was found in two (grade 8) or three clusters (grade 9), and then only in the multi-problem cluster. In general, the types of crime dealt with less serious types as shoplifting and vandalism. The multi-problem cluster at grade 8 and 9 was the only one that indicated more serious crimes as burglary and assault.

At grade 7 (43%) and 8 (44%), the by far most frequent cluster was one without any ASB. This cluster also was most frequent at grade 9, although somewhat decreasing in size (35%). The second most frequent cluster at all ages was one that was characterized by less severe crimes as shoplifting and vandalism (24-31%). Although these two clusters were stable and dominant, others including more types of ASB increased in frequency. At age 13, none of the adolescents belonged to a multi-problem cluster, including both less serious and serious crimes, regular tobacco and alcohol consumption, and repeated truancy in school. At grade 8, 15 out of 778 adolescents (2%) qualified for this cluster, a number that was doubled at grade 9, 35 (4%). When adding the clusters including 3 (i.e., Tobacco, Alcohol, and Delinquency), or 4 types of ASB (i.e., Tobacco, Alcohol, Delinquency, and Truancy), the frequency increased from 4.2% (grade 7), 10.3 (grade 8) to 27.9% (grade 9). (For more information on number of individuals in each cluster that came from either the intervention schools or the control schools, see supplementary Table 4-6 in Appendix.)

Structural stability. Most clusters showed structural stability over time (grades 7 to 8: ASED 0.01-0.13, grades 8 to 9: ASED 0.01-0.92). One exception, however, was the “Tobacco use and Delinquency” cluster in grade 7 and the “multi-problems” cluster in grade 8 (ASED 4.27).

Individual stability. Results from the EXACON analysis (Tables 5-6) showed significant individual stability in cluster membership from grade 7 to grade 8 and from grade 8 to grade 9. Adolescents belonging to a certain cluster at grade 7 tended to belong to a cluster characterized by a similar behavior pattern in grade 8. For example, significantly more adolescents than expected by chance belonged to the cluster “delinquency and bullying” in grade 7 and in grade 8 (observed/expected: 26.0/5.99=4.3 times more likely). The same pattern goes for the clusters at grades 8 and 9. Although stability in cluster membership was high, approximately half of the adolescents moved to new clusters between grade 7 and 8 (48%) and between grade 8 and 9 (45%). In addition, there were some typical movements from the “delinquency and truancy” cluster in grade 7 to the “multi-problem” cluster in grade 8, and from the “delinquency and bullying” cluster in grade 8 to the “multi-problem” cluster in grade 9.

Independent of grade, it was an anti-type for adolescents in the well-adjusted cluster to move to a cluster with any

type of ASB, as well as it was an anti-type for adolescents belonging to any of the cluster including ASB to relocate to the well-adjusted cluster.

Illicit drug use, school grades and depressive symptoms. In grade 9, there were significant differences in reported illicit drug use ($\chi^2=78.5$, $p<.001$) according to cluster membership (Table 7). According to the EXACON analysis, significantly more adolescents than expected in the “tobacco use, alcohol use and delinquency”, the “tobacco use, alcohol use, delinquency and truancy” and the “multi-problems” clusters reported illicit drug use. Of those adolescents belonging to the “well-adjusted” cluster and the cluster including delinquency characterized by less severe forms of criminality, fewer than expected reported illicit drug use.

There were also significant cluster differences in having no grades in one or more subjects ($\chi^2=25.37$, $p<.001$). The EXACON analysis showed that more adolescents than expected in the cluster characterized by “tobacco use, alcohol use, delinquency and truancy” reported having no grades in at least one of the subjects Swedish, English and Mathematics (Table 7). This was mainly due to no grades in Mathematics (data not presented).

Finally, there were significant differences between clusters in the frequency of depressive symptoms ($\chi^2=42.3$, $p<.001$). According to the EXACON analysis, adolescents in the cluster characterized by “tobacco use, alcohol use, delinquency and truancy” were more likely than expected to report depressive symptoms (Table 7). Adolescents in the well-adjusted cluster were less likely to report depressive symptoms.

Discussion

One foundation for more effective prevention efforts is the understanding of how various aspects of antisocial behavior (ASB) interact, particularly in adolescence. Most ASB related research so far has been variable oriented, often using a cross-sectional design. In contrast, this study joins a growing number of studies that have investigated change and stability of clusters of ASB using a person-oriented approach, and one of the few to examine these questions with a contemporary sample of Swedish adolescents. In terms of ASB, we examined adolescents’ use of tobacco and alcohol, delinquent behavior, as well as truancy and bullying at school. Clusters of ASB were, in turn, associated with later illicit drug use, school grades, and depressive symptoms.

In response to first research aim, six clusters of ASB were identified in grades 7, 8 and 9. At grade 7 (43%) and 8 (44%), the most frequent cluster was one that was characterized by the absence of any ASB, and this finding was consistent with our expectations. This cluster also was the most frequent at grade 9 (35%), although decreasing in size. This indicates that engagement in at least some degree of ASB was the norm in this adolescent sample. Furthermore, results revealed an escalation in the frequency and seriousness of ASB over time. At age 13, no adolescents were character-

ized by a multi-problem cluster, including more serious crimes, regular tobacco and alcohol consumption, and repeated truancy in school. At grade 8, 1% of the sample was characterized by this cluster, and 4% at grade 9. Adding two other clusters including three or four types of ASB (mainly with more severe types of tobacco and alcohol use, and delinquency), the frequency increased from 4% at grade 7 to 28% at grade 9. This is fully consistent with the problem gravitation hypothesis put forward by Bergman and Magnusson (1997).

As for the second aim, five of six clusters were identified in all three grades and were structurally stable, that is, similar in shape and level over time. The two patterns identified in previous research (e.g., Connell et al., 2011; Cook et al., 2015; Dever et al., 2017; Sobotkova et al., 2012) also were apparent in this study; the well-adjusted and the multi-problem patterns. The multi-problem configuration we expected would appear at least at grade 9, but in this study was evident at grades 8 and 9.

The third aim dealt with individual stability among adolescents in this sample. Although stability in cluster belonging was high, 48% of adolescents moved to new clusters between grades 7 and 8, and 45% between grades 8 and 9. Independent of grade, it was less common than expected for adolescents in the well-adjusted cluster to move to a cluster with any type of ASB, and also for adolescents characterized by any of the clusters including ASB to relocate to the well-adjusted cluster.

As for the fourth aim, findings showed that one cluster in particular increased the risk of illicit drug use, depression, and having no grade in one or more of the subjects of Swedish, English and Mathematics at grade 9: the cluster that included tobacco and alcohol use, delinquency, and truancy. Adolescents in the multi-problem cluster were also more likely than expected to report illicit drug use, as were adolescents with a combination of tobacco and alcohol use and delinquent behavior. Those belonging to the well-adjusted cluster, however, had decreased risk of illicit drug use and depressive symptoms. These results corroborate previous research that ASB in adolescence has been associated with a range of adverse outcomes in adulthood that include substance abuse, depression, and lack of educational attainment (e.g., Bongers et al., 2008; Miller et al., 2010), and that comorbidity between internalizing and antisocial behaviors warrant careful and increased attention.

Implications for Research and Practice

The sample consisted of adolescents on the verge of an important social transition in relation to schooling, as well as a cohort of youth who experienced stability and change in the development of ASB. The results have implications for research on adolescent development as well as preventive interventions. One implication is that there is a need for additional research on stability and change in patterns of ASB. In applying a person-oriented approach, in this study, heterogeneity in types of ASB was uncovered and specific ASB patterns were found to be prospectively related to

poorer outcomes in adolescence. Further studies are needed to better understand these study results as well as to examine if similar results are found in other Swedish adolescent study samples.

A second implication is the need for longitudinal studies of children before 13 years of age, in order to better understand the emergence of clusters of ASB; more than half of the adolescents in this study reported ASB at grade 7. This need is exemplified by results derived from 1,805 students aged 11 or 12, living in four different European cities: Bologna, Rotterdam, Stockholm and Walsall (Sundell, 2003). According to self-report data, 15% had used tobacco, 2% drugs, and 22% had been drunk.

A third implication regards screening for ASB. Because approximately half of the adolescents changed cluster belonging between grade 7 and 8 and between grade 8 and 9, this illustrates the problems involved in identifying individual adolescents to be involved in selective prevention efforts. Because of poor stability, one or few measurement points may not be enough to decide risk status with individual students (e.g., Åhlén, & Ghaderi, 2019), as a basis to include them in selective and indicated prevention programs. One alternative to this approach is to include all students, independently of risk status. However, in some cases universal prevention may be costly and depending on the prevention target in question, it may not be effective (e.g., Fagan, & Catalano, 2012; Sandler et al., 2014). An alternative is to screen students for ASB to identify schools with high populations of risk clusters. Those schools can then be selected for universal evidence-based interventions targeting specific constellations of ASB (e.g., illicit drug use, and truancy). This type of approach would be in line with interventions such as Communities That Care, which has empirical support on both short and long-time follow-up (e.g., Brown et al., 2014; Oesterle et al., 2015; Rhew, Oesterle, Coffman, & Hawkins, 2018).

A fourth implication is that it may not be ideal for schools to implement several single programs for different problems (e.g., one for bullying, and one for drug prevention), but, it may be better to address these issues using a coordinated multiple problem and strengths-focused approach. Because our results indicated that it is mainly the same adolescents that are the intended audience for many programs, preventive interventions in school should be multiple-problem focused to be more feasible for schools to sustain and to better map on to the etiology of the phenomena targeted for change by interventions.

A last implication is that the pattern that includes truancy significantly increased the risk for illicit drug use, depression, and poor grades. This result may indicate the need for more attention to truancy, rather than early alcohol use and delinquency which are the areas that normally draw a great deal of specific attention in public debate as well as preventive efforts.

Limitations

Given the methodological limitations of the study, all

results should be replicated as well as expanded by more closely looking at the potential importance of gender to these study findings. Our sample of 778 adolescents was considered too small to divide according to gender for the type of analyses performed. However, separate analyses revealed the identified clusters to be similar between boys and girls with respect to both shape and level. Similarly, adolescents in intervention schools and control schools were also analyzed together. As reported in the method section, there are some differences, although considered of less importance for the general picture. It should also be noted that the study sample investigated was significantly better adjusted compared with the full population of students. How this may influence the results is unclear.

The three types of ASB that were included in this study only consisted of one item: frequency of truancy and bullying during the current school year, and alcohol use lifetime. Although these indicators are single item questions, which made the reliability and validity of these measures more complex and in some respects limited, they were included in the present study because of their developmental salience to early adolescence. Furthermore, these single item indicators are characterized by distinct behaviors that should be fairly easy to identify for students, thus potentially enhancing aspects of validity (e.g., face and ecological validity) with an adolescent sample.

Illicit drug use was initially included in the cluster analysis of ASB. There were, however, low frequencies of reported illicit drug use at age 13 (1.5%) and at age 14 (2.3%). Furthermore, most adolescents with reported illicit drug use ended up in the residue group. Thus, it was deemed improper to include illicit drug use in the cluster analysis. Instead, it was included in the outcomes for age 15, together with depressive symptoms and poor school grades.

Although this study provides an example of the benefits of taking a person-oriented approach to understanding ASB, there may be more types of problem behaviors that could modify the clusters (e.g., aggression, sexual risk behavior). Cluster analysis aims at finding reasonably homogeneous subgroups of individuals (Bergman et al., 2003). Some of the obtained clusters in this study had somewhat high homogeneity coefficients, which means they were more heterogeneous than what is optimal. The main reason for this is that, in addition to the LICUR criteria, the final cluster solutions were based on not receiving too small clusters, because an aim was to be able to study the clusters in relation to the outcome variables.

Conclusions

By using a person-oriented approach in examining patterns of ASB in a longitudinal context, this study could uncover subgroups of youth and describe developmental pathways in ASB in relation to outcomes in central areas such as school and mental health. The patterns found at the three grades showed a fair degree of structural stability, as well as individual stabilities in cluster membership between grades. Other key results and conclusions that could be made

was that many youth evidenced no ASB over time, which was consistent with our expectations. However, there was also an increase in the frequency and seriousness of ASB configurations over time. One cluster in particular that was signified by the presence of truancy increased the risk of drug use, depression, and missing grades at grade 9. These study results advance the research literature on adolescent ASB from a pattern-oriented perspective and have important implications for the future design of school-based prevention programs, which should be increasingly multi-problem and resource focused.

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Author Contributions

KS is the principal investigator for the project. JE calculated all statistics. All authors designed and wrote the article.

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